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15 October 1964

Declass Review by NGA.

MEMORANDUM FOR: The Record

SUBJECT: Trip Report, Contract [REDACTED]

PLACE: [REDACTED]

DATE: 8-9 October 1964

The subject contract covers a "High-Resolution Step and Repeat Contact Printer" referred to as printer number 2, and a "Contact Duplicating and Reseau Printer" referred to as printer number 1.

The purpose of this program is to develop items of equipment capable of producing first generation positives, of a quality and resolution greater than that obtainable by any other contact printer, including the Nigara printer, developed by the [REDACTED]. At the same time this printer is being designed to accomplish printing operations not feasible by any other known automatic printer. These additional capabilities include:

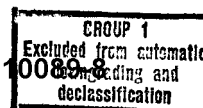
- a. Single printing of selected frames.
- b. Multiple printing of selected frames.
- c. Programming of the printing cycle.
- d. Adjacent printing of stereo-pairs.

The two-day session was planned to allow discussion of Printer number 2 in the morning and Printer number 1 in the afternoon of 8 October; with 9 October reserved for a third discussion covering automatic exposure control, automatic dodging, and possible sources of illumination.

Meeting of 8 October

Those in attendance were:

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5X1 A presentation of the progress to date was given by [REDACTED] project monitor for Printer number 2. He first displayed artist's concept drawings of the Printers. Exterior and interior views were shown. The exterior view showed the printer to be rectangular in shape with a recessed control-panel and door. The interior view showed the raw stock spools and the negative film spools, as well as the manner of transporting film across the platen. It also showed the method of achieving contact by means of an inflatable-deflatable rubber platen. Other components are simulated in the drawing also, for various operating functions of the printer. These are only preliminary sketches. They will be refined within the next 30 days and delivered to the purchaser. The printer is planned to be not more than seven feet long by five feet high by two and one-half feet deep. It will be a self-contained cleanroom operation designed to produce 10, 30" prints per minute, which is equivalent to 25 linear feet per minute. It will have automatic exposure control and possibly automatic dodging. The final determination on this point has not yet been made. The exact method of illumination has not been determined either. This will depend on proposed tests of flying spot scanning such as used in the [REDACTED] printer. Another method considered as a possibility would comprise a series of sealed beam lamps of the type used for individual illumination of passenger seats in aircraft. If this type is used it will comprise approximately 150 lamps under the platen. Each will have a collimator lens that will semi-collimate in a manner that the illumination from the lamps will overlap at the platen sufficiently to prevent mottling or uneven illumination. The human factor's engineers have contributed to plans for the printer, and their work includes the control panel. It is planned that the panel will have an ON and OFF switch; a stand-by switch; a raw stock indicator, to indicate the amount of raw stock remaining; a negative indicator to indicate the footage of negative remaining. It will have a raw-stock advance switch; a negative advance and rewind switch; two film-type switches, for adjustment of the printer to different emulsion types. It will have a manual switch; a program switch; a consecutive-

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switch for program printing from a certain frame to another certain frame. It will have an elaborate program keyboard to permit programming the frames to be printed and the number of prints from each frame. It will have a search key for the purpose of searching out any particular frame in a roll. There will be a test indicator for the purpose of determining whether certain key functions of the printer are in proper operation. A disabled warning horn will be provided. Two counters will also be provided. One will be resettable to count the number of prints in any given job; the second will be non-resettable for the purpose of counting the total cycles of the contact printer. This layout of the control panel is no more than tentative at present. The writer made no attempt to comment specifically on the items included in the control panel. This will be done at a later date when the plan for the panel is finalized, probably during the latter part of December. The power distribution panel and RFI were described. The printer will operate from a 208 volts, three-phase, four wire system and it will be equipped with radio frequency interference filters. The requirement for radio frequency interference testing has been tentatively waived because it would be quite costly and probably would not be necessary for our type of operation. Film coding was a considerable item of conversation because it involves putting some sort of coding on original film, probably on the edge, by which the printer might sense negative frames which have been programmed into the printer for printing.

The film gate was given quite a lot of discussion also. The problem of Newton rings and interference fringes can be quite a problem when trying to achieve absolute contact and maximum resolution. It is probable that no fluid gate will be employed, even though, if a fluid gate proves to be necessary will attempt to include it.

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Film handling was discussed in some detail also. They have quite a large number of possible methods by which the film might be transported from one spool to another. The writer had no specific comment since no method is known which accomodates all the problems that will be encountered in printer design. This is of particular importance since the film must be transported with no scratching or other damage of any kind and with no linear stress. This is necessary because measurements will be made from the film prints.

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25X1 The subject of exposure control was largely deferred until Friday. However, [] gave a very lucid explanation (with the aid of charts) on the sensitometric response that occurs when an original negative image is transferred to a print stock. The charts contained densitometric curves combined with resolution curves to show the relationship of density to resolution. [] explained that where the brightness range of negative images exceed the dynamic range of positive print material only that portion of the image falling within certain narrow density limits on the steepest part of the curve are recorded at maximum resolution. This means of course that in many cases (by normal conventional illumination) one cannot record targets in the shadows and highlights at maximum resolution, on the same film, at the same time. He must expose separately for highlight and shadow targets if maximum resolution is to be achieved for each.

25X1 [] was followed by [] who explained a method by which this situation could be controlled in the printer. He proposed incorporating probably 5 separate switches in the contact printer which would in effect override the density readings or density analyses of the original negative. In his proposal the middle switch would respond normally to the readings of density from the original negative. Two (+) switches above would override to the extent that they would apply exposure greater than that dictated by the exposure control. Two (-) switches below would override to expose less than that dictated by the exposure control. This was a subject of rather long discussion and it seems after serious consideration of the explanation by [] that such a method as described by [] might be quite an advantage in this particular printer. It would provide an opportunity to select that exposure best suited to the particular density which contained the target of interest.

25X1 Design analysis of contact printer number 2 is due the latter part of December. This will call for a very extensive review in order to approve or disapprove the features proposed by [] for that printer.

25X1 Seventeen possible methods of coding original film were considered by []. On the direction of the writer all were discarded except three. These were marking inks of a type used with considerable

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25X1 success by [REDACTED] They are a type that are imbedded into the base of the film but do no damage. They seem to be quite good. The second is Fluorescent Penetrant material that penetrates the base, and is invisible to the eye but suitable for pick-up by a sensing head. The third is an ultrasonic surface deformation method which applies a very smooth light frosting to the base side of the film. It is so light that it does not interfere with printing of images on the emulsion side of the film. The code size tentatively proposed would be 3/32 inch wide by 1 inch long. The code would be in two tracks of 13 bits. The idea of using two tracks would be for fault detection. [REDACTED] has prepared an array of about 30, 400 line/mm targets on an 8" x 10" sheet of film. Later they will produce a 9" x 30" sheet with many more targets arrayed over the format for testing the printer.

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Meeting 9 October 1964

The conference was attended by:

[REDACTED]

25X1 [REDACTED] was engaged by [REDACTED] with help of the writer on a no fee consultant basis. He gave a very excellent and lucid presentation, (even though somewhat biased toward the [REDACTED] system), on the entire mechanism of image transfer and the relationship of spot size to contrast, spot size to resolution, dynamic range of negatives to printing response. The presentation which was attended by [REDACTED] and the writer was much too detailed to include in this report. One of the interesting things [REDACTED] pointed out which was somewhat of a surprise to just about everybody was that he considered photochromics as a rather strong possibility for accomplishment of exposure control as an unsharp mask. He thought that this material could be used in roll form so that after the mask was exposed to accomplish the dodging it could

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advance to a take-up spool and give time for that image to decay before used again. This would, he thought, eliminate possibilities of photochromic fatigue that would probably result if only one photochromic sheet were used. He also mentioned the possibility that infrared quenched phosphor might serve the purpose, but did not seem quite enthusiastic about its possibilities.

[REDACTED] thought the two most promising sources for photochromics were the [REDACTED]

These certainly will be investigated by [REDACTED] for whatever possibility they may hold. [REDACTED] seemed to be so enthusiastic about the possibilities of accomplishing this printing requirement with the

[REDACTED] principle invented by him that the writer asked him if he would accept a challenge to mock-up such a light source for a comparison to the best known methods of image transfer. He said he would accept this and thought he could make a very favorable showing. Exactly how this maybe worked out is not known but it is assumed that [REDACTED]

[REDACTED] will make some sort of agreement on this point. If necessary [REDACTED] will engage [REDACTED] on some consulting basis to accomplish this, provided further consideration shows it to be worthwhile. [REDACTED] raised a very interesting question which was worked out mathematically by [REDACTED] and this is the way it went. [REDACTED] asked if he had an output quality of 500 lines/mm, from a 700 lines/mm target, on a film with a 2000 lines/mm capability, what must the printer capability be. [REDACTED] then wrote an equation on the board and arrived at a number of 700 lines/mm which meant that such an output of 500 lines/mm under the conditions described would indicate that the printer had a capability of 700 lines/mm. All of those present thought this was a very interesting answer.

On the afternoon of the Friday session [REDACTED] and the writer were called out for a meeting with [REDACTED] (Executive Vice-president and Director of all R&D at [REDACTED]) (Director of Applied Research [REDACTED]). It turned out to be quite an interesting meeting because [REDACTED] whom the writer has known many years had to obtain special permission from the President of [REDACTED] to show some results of very highly secret work they have been engaged in over the past year. These results were quite surprising indeed. There were two things.

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25X1 One was a black-and-white continuous-tone duplicate produced on film, paper, glass or any material of your choice, and developed in a liquid solution for no more than a few seconds. They feel that the speed could be as high as ASA 20. This was not demonstrated because there was no time. The second and even more interesting system was an entirely new color process. This color process was one in which all three color sensitive ingredients were mixed in solution, coated on a single film base entirely mixed together as a single coating. According to the description the single coating when exposed to three color print with no fixation required. Apparently mere exposure produces an almost instantaneous color print. They showed transparencies in the form of slides which were copies of Kodachrome transparencies. They were almost unbelievable. [REDACTED] specifically requested that we not reveal this information to unauthorized people. In fact, he requested that we hold it in very strict confidence because he thought their competitors might gain something from this knowledge and that it might have a sharp effect on their stock. They did not want to become involved in any stock speculation. This color system (if as described) in the opinion of the writer is approaching the ultimate. It is a one-layer system which avoids all of the degrading effects very common to all well-known three color emulsions. The writer suggested to [REDACTED] that we make this known to Mr. Lundahl, [REDACTED] and possibly one or two others with the idea that we may (depending on how the demonstration at [REDACTED] turns out) want to exert some extra special effort in this area. It is certainly the most spectacular thing I have seen in some 29 years of exposure to black and white and color photography. I feel also that our organization may want to put some cover on the system because of its possible international importance. I think a visit by Mr. Lundahl and [REDACTED] should be arranged at the earliest possible date.

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25X1 Prior to the first meeting on 8 October, two separate subjects were discussed with [REDACTED] concerning material which they need and want in pursuit of these two printer contracts. One is detailed format data with dimensions and tolerances, location of fiducial marks, data blocks and other pertinent details which might affect the design of the printers. The second is statistical density information from authentic missions. This is necessary for proper design of the lighting system and the automatic exposure control. In each of these cases the information has been compiled but cannot be released to [REDACTED] people until T, KH clearances have been obtained by them. It, therefore, would be most desirable for approximately four (4) persons at [REDACTED] to be given T, KH clearances as soon as possible.

[REDACTED]